

REQUEST FOR PROPOSALS

LTRC 10-4ST

Development of Wave and Surge Atlases for the Design and Protection of Coastal Bridges in South Louisiana

PROBLEM STATEMENT

The failures of highway bridges on the Gulf Coast seen in the aftermath of Hurricane Katrina (2005) were unprecedented. In the past four decades, wind waves accompanied by high surges from hurricanes have damaged a number of coastal bridges along the north coast of the Gulf of Mexico. U.S. Hurricane Camille (1969) caused damage to bridges across Bay St. Louis and Biloxi Bay in Mississippi. The same bridges rebuilt after Camille were damaged again by Katrina. Hurricane Frederic (1979) destroyed the bridge connecting the mainland to Dauphin Island, a barrier island near the entrance of Mobile Bay, Alabama. In the 2004 hurricane season, the bridge on Interstate 10 (I-10) over Escambia Bay in Florida was destroyed by Hurricane Ivan. In addition to the I-10 bridge over Lake Pontchartrain and the two US-9- Highway bridges (Bat St. Louis and Biloxi Bay), mentioned above, Hurricane Katrina also damaged several other bridges, including the ramp between US 98 and I-10 over the head of Mobile Bay, Alabama. A more comprehensive listing of bridges damaged by Katrina can be found in ASCE TCLEE (2006) and Padgett et al. (2008). Although all the bridges damaged by hurricanes mentioned above are situated in bays or estuaries sheltered from the impact of typical ocean swell by barrier islands, the major cause of those bridge failures is the impact of locally generated waves on bridges' superstructures (e.g., Douglass et al., 2006; Chen et al., 2009).

There are a large number of coastal bridges in south Louisiana. How many are vulnerable to the impact of hurricanes? What are the design wave and surge conditions at those bridge sites? How large would the wave forces be on the bridge elements? The design and protection of coastal bridges in South Louisiana needs answers to those questions. Currently, AASHTO's *"Guide Specifications for Bridges Vulnerable to Coastal Storms"* provides a method for the calculation of wave forces. However, design information on both wave height and wave period needed to calculate wave forces is still not available in the United States. Thus, there is a pressing need for research to develop the hurricane wave information, including wave height and wave period, for the design of coastal bridges in south Louisiana.

The storm surge elevation, wave height, and wave period are the three most important wave parameters needed to calculate wave forces according to AASHTO's *Guide Specification for Bridges Vulnerable to Coastal Storms*. The information is currently not available for design purposes.

OBJECTIVE

The objective of this research is to develop wave and surge atlases for the design and protection of coastal bridges in south Louisiana. This may be achieved in the tasks in the Proposed Research section below.

PROPOSED RESEARCH:

The proposal shall address at a minimum, the following tasks:

- Task 1 Perform a literature search to see what other states do regarding the design of bridges in coastal regions.
- Task 2 Assess the vulnerability of Louisiana coastal bridges in the 100-year hurricane flood zone of south Louisiana. Research all available data and information; develop screening criteria and procedures to be used for assessment.
- Task 3 Work with LADOTD to develop criteria needed for selecting bridge candidates for the study. Criteria for bridge selection may be based on location, size, importance, vulnerability, etc... (LADOTD shall approve the list, number, and type of selected bridges.)
- Task 4 Submit a summary report documenting the findings of Task 1 and Task 4. Summary report should not exceed 50 pages. It is anticipated that the PRC will need one month for review and approval of the summary report.

Twenty-five percent (25%) of the total budget will be allowed for Tasks 1 to 4.

A written notification to the PI will be needed before any additional tasks are initiated.

- Task 5 Develop a series of site-specific wave atlases including information on surge height, wave height, and wave period in areas adjacent to selected bridge sites in south Louisiana.
- Task 6 Based on findings from Task 5, calculate the wave force, according to AASHTO's *Guide Specification for Bridges Vulnerable to Coastal Storms*, on coastal bridges selected in Task 3.
- Task 7 Submit a summary report presenting the calculation of the wave force acting on the selected bridges. Selected PI will present his results to the PRC
- Task 8 Develop guidelines for calculate wave forces for LADOTD when designing new bridges or checking existing ones.
- Task 9 Develop and conduct a workshop to train LADOTD personnel on the use of developed wave atlases.

Task 10 Prepare a final report documenting the entire research effort. Based on the performed work, the final report should include guidelines regarding the application and/or limitations of such methods on new and existing structures.

SPECIAL NOTES

- A.** Task descriptions are intended to provide a framework for conducting the research. LTRC is seeking the insights of researchers on how to best achieve the research objectives. Researchers are expected to describe research plans that can realistically be accomplished within the constraints of available funds and contract time. Proposals must present the researchers' current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach.
- B.** The summary report required in Task 4 shall be submitted within 9 months of the work order to proceed.
- C.** LTRC projects are intended to produce results that will be applied in practice. It is expected that an implementation plan for moving the results of the research into practice will evolve as a concerted effort during this project. The final report must contain an implementation plan to include as a minimum, the following: (a) the "product" expected from the research, (b) a realistic assessment of impediments to successful implementation, (c) the activities necessary for successful implementation, and (d) the criteria for judging the progress and consequences of implementation.
- D.** To assist in the implementation process, the researcher shall be prepared to present the final results to DOTD officials in an oral presentation, after acceptance of the final report. One workshop will be provided to DOTD engineers and consultants in order to familiarize them with the findings, recommendations, and guidelines for calculating wave forces on coastal bridges.
- E.** The proposal should include travel to meet with the Project Review Committee for a "kick off" meeting, presentation of interim report, and presentation of the final report at a minimum.

DELIVERABLES

- Summary Report documenting results of Tasks 1, 2, and 3
- Summary Report documenting the computation of wave forces as requested in Tasks 5 and 6
- Guideline for calculating wave forces on coastal bridges as per Task 8
- Final report with recommendations to LADOTD on future design
- Presentation to PRC on findings

- Conduct a workshop to train LADOTD Engineers on calculation of wave forces on coastal bridges using findings from this study.

ESTIMATED COST OF RESEARCH

\$300,000

ESTIMATED COMPLETION TIME

30 Months *(includes one month for review and approval of interim report and three months for review and approval of final report - i.e. final report due 27 months)*

LTRC PRIMARY CONTACT

Walid Alaywan, P.E.
Sr. Structures Research Engineer
Phone: (225) 767-9106
Email: walid.alaywan@la.gov

AUTHORIZATION TO BEGIN WORK:

February 2011

PROPOSAL FORMAT

All proposals are required to be formatted according to LTRC Manual of Research Procedures. Chapter 2 provides guidance on proposal development. A copy of the Manual may be downloaded from our website (<http://www.ltrc.lsu.edu/publications.html>).

PROPOSAL SELECTION

The Project Review Committee selected for this project will review, evaluate and rank all proposals received using the criteria established on the attached proposal review form.

DEADLINE FOR RECEIPT OF PROPOSALS

Ten copies of the proposal must be received by LTRC by the close of business day of Wednesday, December 15, 2010.

Proposals should be submitted to:

Mr. Harold Paul, P.E.

Director
Louisiana Transportation Research Center
4101 Gourrier Ave.
Baton Rouge, LA 70808

To equitably answer any questions regarding this Request for Proposals, the Louisiana Department of Transportation and Development (LADOTD) website, <http://notes1/agrestat.nsf/WebAdvertisements?OpenPage> will be updated with questions and answers and related documents regarding the project. The LADOTD

makes these documents available for informational purposes only to aid in the efficient dissemination of information to interested parties. The LADOTD does not warrant the documents against deficiencies of any kind. The data contained within this web site will be periodically updated. Interested parties are responsible to be aware of any updates. Questions regarding this RFP should be submitted in writing to the LTRC contact person. Questions must be received by close of business seven calendar days prior to deadline date.